

REMARKS

This responds to the Office Action mailed on 7 February 2007.

Claims 1, 8, 23, 29, 30, 36, 44, 45, 50, 56, 59, 63, 66, 72, and 76 are amended, no claims are canceled, and no claims are added; as a result, claims 1-79 are now pending in this application. The amendments to the claims are made to clarify these claims. The amendments to the claims are fully supported by the specification as originally filed. No new matter is introduced. Applicant respectfully requests reconsideration of the above-identified application in view of the amendments above and the remarks that follow.

Support for the amendments to the claims may be found in the claims. Further, additional support for claim 36 may be found in the specification, for example, on page 10, lines 7-9.

Claim Objections

Claim 29 was objected to as being a duplicate of claim 22. Claim 29 is amended to correct a typographical error with respect to the dependency of this claim. No new matter is introduced.

Applicant respectfully requests withdrawal of these objections of claim 29, and reconsideration and allowance of this claim.

§102 Rejection of the Claims

Claims 36-43 were rejected under 35 U.S.C. § 102(e) for anticipation by Edelstein et al. (U.S. 6,181,012). Applicant traverses these grounds of rejection of these claims.

Claim 36 is amended to clarify the claim.

In the Office Action, it is stated that “Edelstein discloses . . . a first level via (in which stud 62 being formed) . . . a barrier/adhesion layer 70/72 having two material layers (col. 6 line 62 to col. 7, line 2), the barrier/adhesion layer 70/72 disposed on a first level via.” Applicant notes that a patentee, such as Edelstein, may be his own lexicographer, but Applicant submits that a naming convention in the patent of such a patentee does not *per se* extend to patents or patent applicants of other inventors. Applicant notes that, though Edelstein et al. (hereafter Edelstein) at column 6, lines 64-66 indicates that insulating layer 70 may be a diffusion/adhesion

barrier layer, Edelstein's Figure 2 shows that insulating layer 70 is not disposed on stud 62. In addition, Application cannot find in Edelstein a disclosure, a teaching, or a suggestion of a barrier/adhesion layer having two metal layers as recited in amended claim 36.

Applicant submits that Edelstein does not teach each and every claim element of claim 36, that Edelstein does not teach the identical invention in as complete detail as is contained in claim 36, and that Edelstein does not teach each and every claim element arranged as in claim 36. Thus, Applicant submits that Edelstein does not anticipate claim 36 and that claim 36 is patentable over Edelstein for at least the reasons stated above. Additionally, claims 37-43 depend on claim 36 and are patentable over Edelstein for at least the reasons stated above.

Applicant respectfully requests withdrawal of these rejections of claims 36-43, and reconsideration and allowance of these claims.

Second §102 Rejection of the Claims

Claims 44-65 were rejected under 35 U.S.C. § 102(e) for anticipation (see below regarding alternative rejection under 35 U.S.C. § 103(a)) by Edelstein et al. (U.S. 6,181,012). Applicant traverses these grounds of rejection of these claims.

In the Office Action, it is stated that "Edelstein does not specifically teach that the barrier layer 72 including zirconium or hafnium." Therefore, Applicant submits that Edelstein does not anticipate claim 44. Thus, Applicant submits that claim 44 is patentable over Edelstein. For at least reasons similar to those stated for claim 44, Applicant submits that independent claims 50 and 59 are not anticipated by Edelstein and are patentable over Edelstein. Applicant further submits that claims dependent from independent claims 44, 50, and 59 are patentable for at least the reasons stated herein.

Applicant respectfully requests withdrawal of these rejections of claims 44-65, and reconsideration and allowance of these claims.

First §103 Rejection of the Claims

Claims 1, 8, 23, and 30-35 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Edelstein et al. (U.S. 6,181,012). Applicant traverses these grounds of rejection of these claims.

In the Office Action, it is stated that “it would have been obvious to one having ordinary skill in the art at the time of the invention was made to use zirconium or hafnium as a barrier material because they are well known barrier materials, along with (or, that can be used interchangeably with) titanium, tantalum, tungsten, etc.” Applicant respectfully disagrees. First, Applicant submits that different materials have different chemical properties, typically based on such characteristics as different atomic properties, structure, and reaction with other materials, to name a few. As a result, use of a number of different materials in a specific application for a diffusion barrier does not teach or suggest that these different materials are interchangeable for all applications for a diffusion barrier, separate from the specific application. A set of elements identified in a patent teaches that this set of elements may be used for the particular application disclosed in that patent. Therefore, with respect to patentability of a different application, Applicant submits that the use of known materials must be considered with respect to the application of the known materials in a claim of the application under consideration, where the claim is taken as whole. In determining the differences between the prior art and the claims, the question under 35 U.S.C. 103 is not whether the differences themselves would have been obvious, but whether the claimed invention as a whole would have been obvious. *Stratoflex, Inc. v. Aeroquip Corp.*, 713 F.2d 1530, 218 USPQ 871 (Fed. Cir. 1983); *Schenck v. Nortron Corp.*, 713 F.2d 782, 218 USPQ 698 (Fed. Cir. 1983); *Interconnect Planning Corp. v. Feil*, 774 F.2d 1132, 1143, 227 USPQ 543, 551 (Fed. Cir. 1985); MPEP § 2141.02. Applicant submits that merely stating that zirconium or hafnium are known diffusion materials does not consider zirconium or hafnium as claimed in claim 1 of the instant application, for example.

In the Office Action, it is stated that “it is obvious that selecting a known material on the basis of its suitability for the intended use is just within the general skill of a worker in the art. In *re Leshin*, 125 USPQ.” Applicant respectfully submits that the claims of the instant application are distinguished from claims to which *In re Leshin* may be applied. According to *In re Leshin*, “[m]ere selection of known plastics to make a container-dispenser of a type made of plastics prior to the invention, the selection of the plastics being on the basis of suitability for the intended use, would be entirely obvious.” *In re Leshin*, 125 USPQ 416, 417. As shown from this quote, the issue in this case dealt with a selection of a plastic from known plastics for use in container, where plastics were known to be a material for such containers and where the intended

use of plastic containers was as a container. Applicant cannot find a discussion of the known plastic or the known plastic container to be structured or used in a novel matter by the claims under consideration in *In re Leshin*, that is, the novelty and obviousness factors of the selected plastic were addressed with respect to the plastic container used as a container and not other limitations dealing with unknown parameters.

In contrast, the independent claims of the instant invention include zirconium or hafnium in a barrier/adhesion layer structured in an integrated circuit in a manner not taught by the cited art. For example, an additional feature of the barrier layer containing zirconium or hafnium in the claim 1 of the instant application includes the barrier/adhesion layer having a thickness in the range of 5 to 150 Angstroms. Applicant cannot find in Edelstein and the cited references, as proffered in the Office Action, a teaching that zirconium and hafnium may be material for barrier layers at such extremely small thicknesses. Applicant notes that zirconium and hafnium are elements and that structural use of such materials depends on their individual chemical properties and characteristics. Applicant also notes that structural use of elements at extremely small dimensions can not *per se* be predicted by their structural use at large dimensions. From the cited references, it is clear that a zirconium layer or a hafnium layer, as cited in the claims of the instant application, structured to act as a barrier/adhesion layer in an integrated circuit is unknown, except as taught in the instant application. Therefore, Applicant submits that, taken as a whole, each claim of the instant application, reciting hafnium or zirconium as structured in these claims, removes the use of hafnium and zirconium as known barrier/adhesion barrier materials in known applications. Thus, Applicant submits that *In re Leshin* does not apply to the claims of the instant application.

Applicant cannot find in Edelstein a teaching or a suggestion of an integrated circuit including a barrier/adhesion layer having a thickness in the range of 5 to 150 Angstroms formed on a first level via, where the barrier/adhesion layer includes zirconium or hafnium as recited in claim 1. Applicant submits that Edelstein does not teach or suggest all the elements of claim 1 and that claim 1 is patentable over Edelstein. For at least reasons similar to those discussed above with respect to claim 1, Applicant submits that independent claims 8, 23, and 30 are patentable over Edelstein. Claims 31-35 depend on claim 30. Applicant submits that claims 31-35 are patentable over Edelstein for at least the reasons stated herein.

Applicant respectfully requests withdrawal of these rejections of claims 1, 8, 23, and 30-35, and reconsideration and allowance of these claims.

Second §103 Rejection of the Claims

Claims 44-65 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Edelstein et al. (U.S. 6,181,012). Applicant traverses these grounds of rejection of these claims.

For at least reasons similar to those discussed above with respect to the patentability of claim 1 over Edelstein, Applicant submits that amended claim 44 is patentable over Edelstein. For at least reasons similar to those stated for claim 44, Applicant submits that amended independent claims 50 and 59 are patentable over Edelstein. Applicant further submits that claims dependent from independent claims 44, 50, and 59 are patentable for at least the reasons stated herein.

Applicant respectfully requests withdrawal of these rejections of claims 44-65, and reconsideration and allowance of these claims.

Third §103 Rejection of the Claims

Claims 1-13, 18-29, and 44-79 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Havemann et al. (U.S. 6,538,849). Applicant traverses these grounds of rejection of these claims.

In the Office Action, it is stated that “it would have been obvious to one having ordinary skill in the art at the time of the invention was made to use zirconium or hafnium as a barrier material because they are well known barrier materials, along with (or, that can be used interchangeably with) titanium, tantalum, tungsten, etc.” Applicant respectfully disagrees. First, Applicant submits that different materials have different chemical properties, typically based on such characteristics as different atomic properties, structure, and reaction with other materials, to name a few. As a result, use of a number of different materials in a specific application for a diffusion barrier does not teach or suggest that these different materials are interchangeable for all applications for a diffusion barrier, separate from the specific application. A set of elements identified in a patent teaches that this set of elements may be used for the particular application disclosed in that patent. Therefore, with respect to patentability of a different application,

Applicant submits that the use of known materials must be considered with respect to the application of the known materials in a claim of the application under consideration, where the claim is taken as whole. In determining the differences between the prior art and the claims, the question under 35 U.S.C. 103 is not whether the differences themselves would have been obvious, but whether the claimed invention as a whole would have been obvious. *Stratoflex, Inc. v. Aeroquip Corp.*, 713 F.2d 1530, 218 USPQ 871 (Fed. Cir. 1983); *Schenck v. Nortron Corp.*, 713 F.2d 782, 218 USPQ 698 (Fed. Cir. 1983); *Interconnect Planning Corp. v. Feil*, 774 F.2d 1132, 1143, 227 USPQ 543, 551 (Fed. Cir. 1985); MPEP § 2141.02. Applicant submits that merely stating that zirconium or hafnium are known diffusion materials does not consider zirconium or hafnium as claimed in claim 1 of the instant application, for example.

In the Office Action, it is stated that “it is obvious that selecting a known material on the basis of its suitability for the intended use is just within the general skill of a worker in the art. In *re Leshin*, 125 USPQ.” Applicant respectfully submits that the claims of the instant application are distinguished from claims to which *In re Leshin* may be applied. According to *In re Leshin*, “[m]ere selection of known plastics to make a container-dispenser of a type made of plastics prior to the invention, the selection of the plastics being on the basis of suitability for the intended use, would be entirely obvious.” *In re Leshin*, 125 USPQ 416, 417. As shown from this quote, the issue in this case dealt with a selection of a plastic from known plastics for use in container, where plastics were known to be a material for such containers and where the intended use of plastic containers was as a container. Applicant cannot find a discussion of the known plastic or the known plastic container to be structured or used in a novel matter by the claims under consideration in *In re Leshin*, that is, the novelty and obviousness factors of the selected plastic were addressed with respect to the plastic container used as a container and not other limitations dealing with unknown parameters.

In contrast, the independent claims of the instant invention include zirconium or hafnium in a barrier/adhesion layer structured in an integrated circuit in a manner not taught by the cited art. For example, an additional feature of the barrier layer containing zirconium or hafnium in the claim 1 of the instant application includes the barrier/adhesion layer having a thickness in the range of 5 to 150 Angstroms. Applicant cannot find in Havemann and the cited references, as proffered in the Office Action, a teaching that zirconium and hafnium may be material for barrier

layers at such extremely small thicknesses. Applicant notes that zirconium and hafnium are elements and that structural use of such materials depends on their individual chemical properties and characteristics. Applicant also notes that structural use of elements at extremely small dimensions can not *per se* be predicted by their structural use at large dimensions. From the cited references, it is clear that a zirconium layer or a hafnium layer, as cited in the claims of the instant application, structured to act as a barrier/adhesion layer in an integrated circuit is unknown, except as taught in the instant application. Therefore, Applicant submits that, taken as a whole, each claim of the instant application, reciting hafnium or zirconium as structured in these claims, removes the use of hafnium and zirconium as known barrier/adhesion barrier materials in known applications. Thus, Applicant submits that *In re Leshin* does not apply to the claims of the instant application.

Applicant cannot find in Havemann et al. (hereafter Havemann) a teaching or a suggestion of an integrated circuit including a barrier/adhesion layer having a thickness in the range of 5 to 150 Angstroms formed on a first level via, where the barrier/adhesion layer includes zirconium or hafnium as recited in claim 1. Applicant submits that Havemann does not teach or suggest all the elements of claim 1 and that claim 1 is patentable over Havemann. For at least reasons similar to those discussed above with respect to claim 1, Applicant submits that independent claims 8, 18, 23, 44, 50, 59, 66, 72, and 76 are patentable over Havemann. Applicant submits that the claims dependent on claims 8, 18, 23, 44, 50, 59, 66, 72, and 76 are patentable for at least the reasons stated herein.

Applicant respectfully requests withdrawal of these rejections of claims 1-13, 18-29, and 44-79, and reconsideration and allowance of these claims.

Allowable Subject Matter

Claims 14-17 were allowed. Applicant acknowledges allowance of claims 14-17.

RESERVATION OF RIGHTS

Applicant does not agree with one or more comments in the instant Office Action. However, Applicant has limited the discussion of the Office Action rejections to such discussion as is necessary to efficiently expedite the prosecution of the abovementioned application.

Applicant reserves the right to further address the comments of the Examiner at a later date if necessary.

CONCLUSION

Applicant respectfully submits that the claims are in condition for allowance, and notification to that effect is earnestly requested. The Examiner is invited to telephone Applicant's attorney at (612) 371-2157 to facilitate prosecution of this application.

If necessary, please charge any additional fees or credit overpayment to Deposit Account No. 19-0743.

Respectfully submitted,

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By his Representatives,

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Date 2 May 2007

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CERTIFICATE UNDER 37 CFR 1.8: The undersigned hereby certifies that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail, in an envelope addressed to: Mail Stop Amendment, Commissioner of Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on this 2 day of May 2007.

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